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EP 0307126 A1 WO 95/04972 A1 WO 90/00777 A1
US 4956829 A

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(54) Idealised time display device to combat jet-lag

(57) A device is described to minimise the affects of jet lag on journeys between time zones by displaying a non-existent idealised time at 12 which gradually changes (speeding up or slowing down normal clock time) from the local departure time to the local arrival time, thereby changing the users perspective of zonal time change gradually. The device displays messages at 2 which tell the user what to do to minimise jet-lag, eg drink coffee. The variables (local time, journey time, destination time and direction of travel) are entered by the user. The device may be incorporated into a pocket calculator, electronic note book or computer.

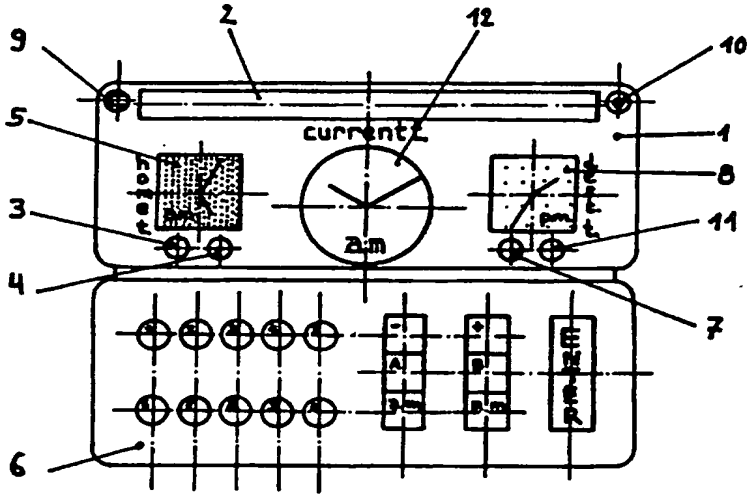

Fig. 1

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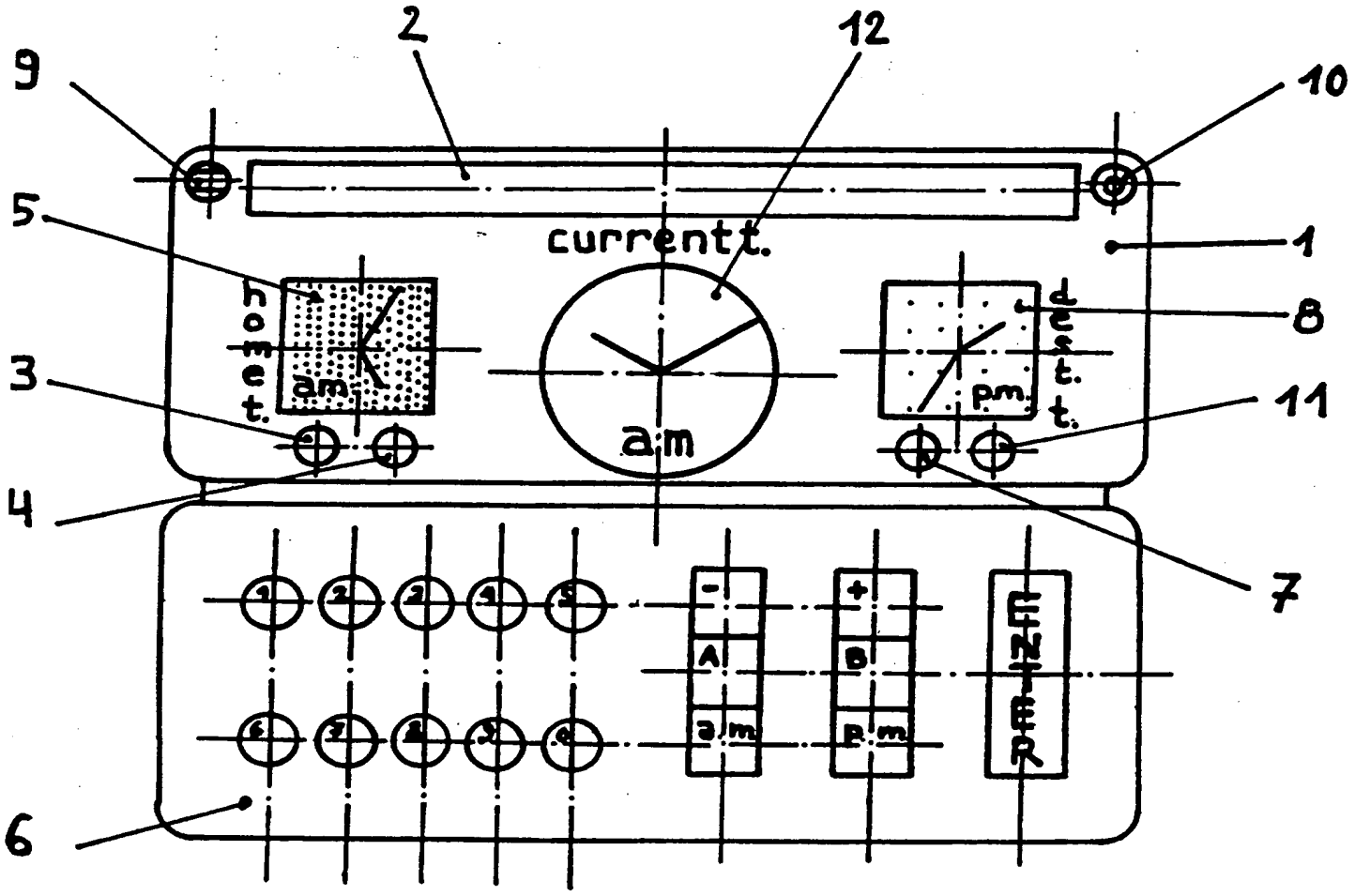

Fig. 1.

Invention Title:
Apparatus for Providing Cognitive Zeitgeber Cues During Transmeridial Flight

Preamble:

One of the major problems in rapid transmeridial flight is the syndrome of 'jet lag' which affects most travellers and aircrew, as evidenced by compromised feelings of well-being, physiological function and cognitive performance.

Over the past two decades the magnitude of the problem has increased due to greater preponderance of long haul jet travel. The increase in passengers handled by London Heathrow jumped from a total of 41 million in 1990 to 51 million by 1994. Other main European airports report a similar increase, although already operating with high numbers (Frankfurt 34 million, Paris Charles de Gaulle 28 million).

The British Airport Authority estimates the origin and destination of traffic 1994/95 to be a total of over 13 million on the North Atlantic run with a further 14.5 million on other long haul destinations.

With British Airways alone employing 30,000 flight crew the problem of airside safety and efficiency of operations is obviously sizeable.

Symtomatology:

Subjects suffering from 'jet lag' may present a variety of symptoms, among others:

a) Disorientation
b) Reduced cognitive ability, reduction in simple reasoning tasks
c) Decreased vigilance and alertness
d) General feeling of malaise and discomfort, headache

e) Gastro-intestinal disorders
f) Sleep disturbances, ranging from mild to severe

Sci ntific Research:

There is a substantial body of scientific literature produced over the past three decades investigating this phenomenon from a variety of perspectives. Driven by aerospace research and the problems of commercial flightcrew the literature review carried out showed over 2000 citations of which 150 were obtained and studied. (Please see Appendix 1 for a list of the most relevant references.)

The major directions of this research have been:

1. The elucidation of the endogenous/exogenous biological rhythmicity as evidenced by core body temperature, nocturnal melatonin peak, other hormonal or metabolite levels.

2. Exploration on the use of photic cues (intensity in excess of 1500 lux) to assist reentrainment of circadian rhythms.

3. Epidemiological data shows various anomalies in the health and behaviour of shiftworkers pointing to the major long term effects of circadian shifts.

4. Dietary consideration have been the subject of a number of studies.

Aetiology:

'Jet Lag' appears to be caused by desynchronisation of various absolute and relative biological rhythms which are normally kept in place by rapid temporal shifts in the time keeping cues (zeitgebers) which normally occur in the environment - such as the light:dark cycle, feeding and social cues, plus various cognitive inputs.

Current Treatment Approaches:

1. Ingestion of chronobiotics - primarily melatonin, or benzodiazepines - using various regimens.

2. Specifically timed application of bright light.

3. Timed ingestion of particular liquid and solid foods.

4. Application of social cues, exercise.

The Inventive Step:

Provide cognitive input by means of time matrix orientation zeitgeber, displaying 'home' time, 'destination' time and 'current' (or 'actual') time.

A Basic Embodiment of the Invention:

An embodiment of the invention will now be described by way of example without implication of any limitations.

The invention consists of a clock device, one alphanumeric and three clock displays as illustrated in Fig. 1. All clock displays are 12 hour with a.m./p.m. indication. Both analog and digital displays can be used, a 24 hour display might be used as well.

In Fig. 1. the housing, 1, with plan dimensions in pocket size, contains a 40 character alphanumeric backlit display, 2.

The setting up of the apparatus using software to guide the user through the whole setting process will now be described. Versions in different languages will be available respecting the direction of reading in the set-up of home and destination clock (i.e. The Arab version will display destination time on the lefthand side). Non-menu controlled setting instructions may be provided, as well as other designs and orientations of the clocks.

Pressing mode button 3 makes clock 5 blink to indicate that it may be set. The display prompts: 'Key in local time: 00:00:xx' . The user keys in the local time in hours and minutes and a.m./p.m. using the attached keyboard, 6, pressing 'ENTER' after input.

Then clock 8 blinks and the display prompts: 'Key in time difference: x 00:00' . The user keys in the time difference between home and destination time. S/He begins with + or - and then the hours and minutes of time difference finishing with 'ENTER'.

Having done this the display prompts: 'Start clocks by pressing ENTER' . This enables the user to synchronize the clocks to external standard time.

Having started the clocks the display prompts: 'Key in flight duration: 00:00' . The user keys in the flight time by again using the keyboard finishing with pressing 'ENTER'.

Now the display prompts: 'Flight direction? Eastward=- Westward=+' and the user answers by pressing the + or - key and confirming with 'ENTER'. This option is necessary when flying across more than a 120 meridians (like for example from London, U.K. to Sidney, Australia) or crossing more than 8 time zones, as there are scheduled routes going eastward and westward. This input is also necessary to respect flights crossing the date line (like for example Tokyo-Honolulu), as then a theoretical time difference of +19hours is to be transformed to a 19-24=-5hours time difference.

Then the display prompts: 'Push start button at take-off' (Start button,7) .

So does the user's action the apparatus confirms its start in two ways:

The display will show the message: 'Please fasten your seatbelt' and the centre clock, 12, will display the same time like the 'home' time clock. In Fig.1. the 'current' time clock is round in order to provide form contrast to the squared home and destination clocks. The colour scheme of background and dial information is also contrasting to that of the two adjacent clocks.

The invention is that after the apparatus has been started the centre clock advances or delays in that way that home time gets continuously adjusted to destination time leaving the user with the impression that his/her inner biological clock is being constantly reset in the same way. The time is adjusted in a way which respects the flight direction and so the position of the sun. As local times are defined by the position of the sun, it makes sense to call the adjusted time and on the centre clock as 'current' or 'actual' time.

The fact that the 'current' time obviously seems to correspond with the natural photic zeitgeber of the light:dark cycle experienced by the user in a normal environment keeps the user oriented in the current environment. These natural photic cues are dependent on the meridian the user is currently positioned on during his/her journey. To make the cue even more obvious the dials of the clocks change their colours with the sunrise and sunset at the concerned geographical locations, i.e. if it is dark at the home airport, the home clock dial will show a dark background colour, and if it is daytime, the dial will be bright.

The destination time is to be reached by the centre clock after about 95% of the total travel time has passed so that it can be assumed that in any case the 'current' time equals destination time before scheduled landing. At the time point 'current' time = destination time, the central clock gets synchronised with the destination time and finally, after some further time the squared clocks stop displaying the time and the centre clock alone shows the time at the destination airport. The apparatus might contain the option which makes it usable as an alarmclock. Therefore it is equipped with alarm-off button, 4, and it will have the software to set the clock and alarm.

1o min after the apparatus was started the quoted message ('Please fasten your seatbelt') will disappear from the display, but further messages may be read from the display during the flight to make the user regard the apparatus frequently. These messages will give advice to take particular drinks or food at special points of time calculated from the input data to minimise the effect of jet lag. (The software will respect very fast flights which cause the 'current' time standing still or even going backward, like it may occur on scheduled flights, for example Paris-New York on Concorde.) Giving messages to the user also bears the positive side effect of creating confidence in the apparatus which obviously 'cares' for its user and so supporting its positive impact on the readjustment of the user's circadian rhythm.

Once started the 'current' time is thus constantly displayed on the centre clock and provides the user with a powerful zeitgeber, or time cue.

It is recommended that the user places the invention within his/her line of vision during the

flight and that it should be referred to frequently thus reinforcing the zeitgeber effects. Both deliberate and undeliberate perception of 'current' or 'actual' time works as an orientation aid and may minimise jet lag. The underlying effect is autosuggestion (the travelling person feels his/her biological clock continuously adjusted to the current environment and finally to the time at his/her destination) and the nonoccurance of the time reset shock when the travelling person sets his/her watch in one step.

As it has been shown that the ingestion of inflight methylated thioxanthenes (eg. coffee, tea), or proeteins, etc. at certain times relative to the individuals circadian clock have beneficial effects for biorhythmic reentrainment, the apparatus will give the appropriate information ('Have a cup of coffee/tea', etc.), as described, the beneficial effect against jet lag will surely occur. It is also thought of equipping the apparatus with an audio or optical (in Fig.1. 9,10) alarm to announce the user when it is time to look at the display.

Non-scheduled delays on ground and the like may be catered for by a GROUND button, 11. Pressing it causes that the 'current' time of the centre display advances in phase with real time displayed on home and destination clock. The display will prompt: 'Restart clock at resumption of journey' which the user does by pressing START button, 7.

In a preferred embodiment of the invention the system contains annual meteorological (eg. temperature, rain) data pertaining to sunset and sunup at each airport location. This information is used by the onboard microprocessor to exchange the background and foreground colours of the time displays thus giving the viewer a highly ergonomic time orientation cue (regarding the natural light:dark cycle). Means are also provided for the selection and display of departure and destination airports by means of pushbuttons, A and B, which permit scrolling of each selection. Thus the setting of home and destination clocks can be achieved by reporting home and destination airport and various local time changes such as Summer Time where appropriate.

Models of the invention containing further options like electronic notebook, pocket-calculator or even micro-computers are also in preparation, as well as the software to display the apparatus on the screen of a computer allowing the user to keep the current time in sight while working with the computer.

Appendix 1

1 Melatonin: The internal zeitgeber of mammals?, 1989, Pineal Research Reviews 7
2 Restricted feeding: a nonphotic zeitgeber in the rabbit, 1991, Physio & Behav 51
3 Circadian rhythms, jet lag, and chronobiotics: an overview, 1994, Chronbiol Intern vol11-4
4 Circadian rhythms and the effects of long-distance flights, 1968, US Govern Res Reports
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6 Can pharmacological agents be used effectively in the alleviation of jet-lag?, 1992, Drugs vol43-2
7 Pharmacological resetting of circadian sleep-wake cycle, 1988, NASA-Abstract
8 Investigations on the use of light and melatonin for alleviation of problems related to jet lag and shift work, 1993, Biolog Effects of Light
9 A hunting for the wonder pill for resetting all biological clocks, 1987, Ann Rev Chronobiol
10 Some effects of jet-lag and their alleviation by melatonin, 1987, Ergonomics 30-2
11 Effects of diazepam on the circadian phase advances and delays, 1986, Brain Res 372
12Plasma concentrations of melatonin in man following oral absorption of different preparations, 1985, Brit J Clin Pharma 19

Claims:

1. An electricity powered timekeeping device with the facility to display the continuously accelerated or delayed time related proportionately to the time zone difference between departure and arrival points and travel duration.

1a. A device as under 1, respecting the flight direction and crossing of the date line when displaying the 'current' time.

1b. A device as under 1, and 1a, automatically displaying the time of the timezone the vehicle is supposed to be in after a particular period of travel.

1c. A device as under 1, 1a, and 1b, to be mainly used on other fast moving vehicles, like catarmerans or high speed trains, etc.

1d. A device as in 1, 1a, 1b, and 1c with the facility to display 'home' and 'destination' time by means of selecting the respective departure and destination locations on a scrolled display.

1e. A device as in 1, 1a, 1b, 1c, and 1d which is to be started or starts with an advance or delay, but then adjusts home time to destination time continuously or incrementally.

1f. A device as in 1, 1a, 1b, 1c, 1d, and 1e which adjusts home time to destination time using modified variables.

1g. A device as in 1, 1a, 1b, 1c, 1d, 1e, and 1f which adjusts times in the range of home and destination times.

1h. A device as in 1, 1a, 1b, 1c, 1d, 1e, 1f, and 1g which is centrally operated or controlled.

2. Relevant proportions of the device may be operated mechanically, or by using optical or acoustical means.

3. The software to provide the described and in 1, 1a, 1b, 1c, 1d, 1e, 1f, 1g and 1h claimed functionality to be run on a delivery vehicle (like for example lab-top computer).

4. Claim on the zeitgeber effect of frequently or continuously displayed and/or perceived 'current' time, or repeated provision of information on timezone the vehicle is in at any particular moment of travel.

5. Claim on the algorhithmic time of chronobiotic ingestion cues, or chronobiotic pharmacologically active substances and other means of delivery zeitgeber information, like exposure to bright light, or exercise at particular time points calculated by using a set of data containing home time, destination time, flight duration, 'current' time.

6. Claim on changing foreground/background colour of any device to indicate light:dark conditions at home and destination and during travel.

7. A multipurpose clip enabling the setting up of the device in a tabletop viewing position, in hanging positi n from forward seat, as well as the facility to be wristworn by means of tennis-type wristband.

Patents Act 1977 Examiner's rep rt to the Comptroller under Section 17 (The Search report)	Application number GB 9517120.3
Relevant Technical Fields (i) UK Cl (Ed.N) G3T (TA4B3), G4A (ACX, AUXX) (ii) Int Cl (Ed.6) G04B 19/00, /22, 26; G04G 1/00, 9/00, G06F 17/00	Search Examiner R D CAVILL Date of completion of Search 7 NOVEMBER 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 1, 2 AND 7

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	EP 0307126 A1	(BICK) see whole document	1 at least
X	WO 95/04972 A1	(NIX) see whole document	1 at least
X	WO 90/00777 A1	(KINETIC) see whole document	1 at least
X	US 4956829	(MITCHELL) see whole document	1 at least

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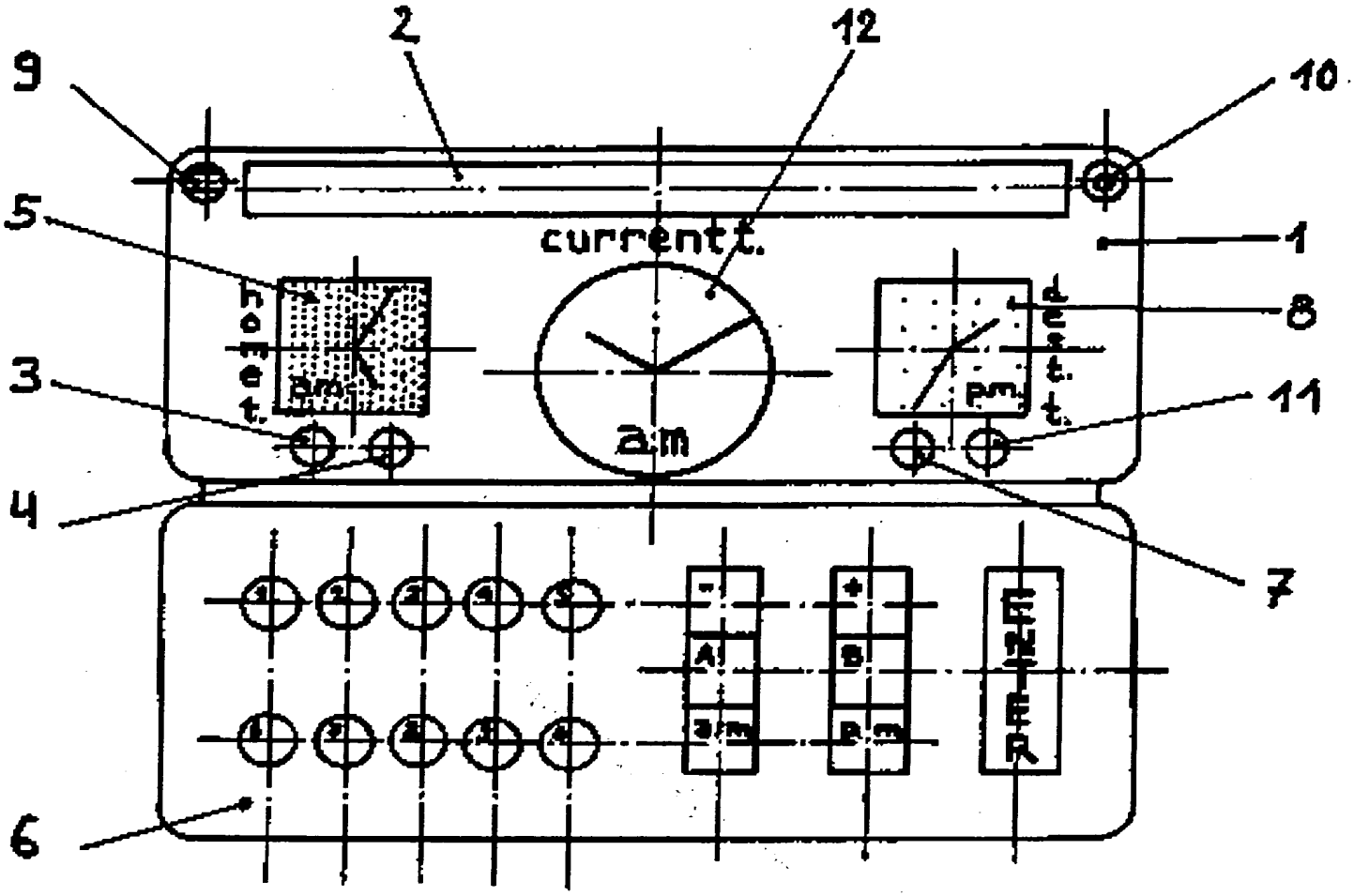

Fig. 1.